Outside The Box:

SETI Begins At Home

What is your computer doing right this second? Chances are it is showing a screen saver, waiting for you to type a letter, or otherwise twiddling its digital thumbs, just waiting for something to do. A typical computer spends the vast majority of its time waiting around for its human with only a fraction of the processor's power actually put to use.

SETI@home (www.setiathome.ssl.berkeley.edu), a groundbreaking project at the University Of California-Berkeley, is putting millions of idle computers to work searching for signs of life on other worlds.

SETI, or Search For Extra-Terrestrial Intelligence, is a group devoted to using its PCs to listen for radio signals from space, which may indicate the presence of life outside of Earth. The heart of the SETI@home project is a screen saver, a program that uses a PC's otherwise-idle processor time to examine data collected by a powerful radio telescope at the Arecibo Observatory in Puerto Rico (www.naic.edu).

How can your computer contribute to such a complex scientific endeavor? The SETI@home server sends each participating computer a chunk of data to analyze. When that PC finishes chewing on its relatively small bite of work, it sends the results back to the server and gets another chunk to work on. This is called distributed computing, which is the term for a project that breaks a complex task into small parts and sends each part to a different computer.

About 5 million people worldwide have taken part in SETI@home, with about 500,000 currently active. With enough computers on the job, the end result is faster than the fastest supercomputer. Averaging 70 teraFLOPS (that is, 70 trillion floating-point operations per second), SETI@home's speed is roughly twice that of the largest conventional supercomputer, NEC's Earth Simulator.

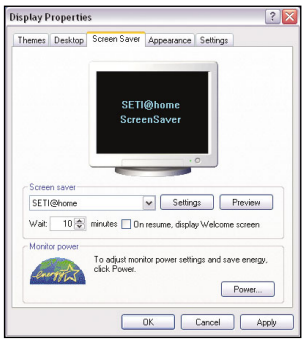
The Project's Origins

David Anderson, director of SETI@home, is a former computer science professor at Berkeley. A graduate student named David Gedye came up with the idea for the project in 1994 after watching TV documentaries about the Apollo moon landing. "One striking aspect of the Apollo project was the way it got everybody in the U.S. and the world interested and excited in a scientific project. It gave people the idea of a shared purpose," Anderson said. That got Gedye's wheels turning: What project today could have a similar effect?

With a booming number of powerful personal computers able to access the Internet, most of which were sitting idle 99% of the time, Gedye "identified SETI as a scientific problem that is interesting to a lot of people and also has a use for computer time," Anderson said. The idea was to use digital signal processing to analyze radio waves captured by radio telescopes. More computer power means we can hear less powerful signals.

Gedye discovered that U.C. Berkeley already had a radio SETI project, which launched in 1991. Folks at Berkeley discovered a way to record data full time from a radio telescope even while someone else was controlling it, in effect eavesdropping on others' telescope time. "One of the challenges of using big observatories is everyone wants to use them. Often you only get one day of telescope time a year," Anderson said. It would prove to be a perfect source for radio telescope data to analyze.

SETI@home needed money. A three-year search for funding was "in some ways the hardest part," Anderson said. They turned down funding offers from several nonscientific groups including television studios and UFO hunters. The project ultimately hooked up with the Planetary Society (www.planetary.org), a scientific organization founded by Carl Sagan in 1980. Other contributors included Paramount Pictures and Starwave, a company then owned by Paul Allen.



Set the length of time before the screen saver kicks in using the Displays control panel in Windows.

It took a year to develop the SETI@home software. "In retrospect it's

kind of amazing we did it that quickly," Anderson said. The project launched in May 1999 and was expected to continue for two years. Five years later, the project is still going strong, scanning 96% of the visible sky, and the majority of that has been scanned two or more times.

Recent Developments

"We've been working in two main directions this past year," Anderson said. "First, we've been trying to find ET [extraterrestrial life]. The upshot is that we didn't find any ET signals. This is disappointing but not discouraging. Radio SETI technology is constantly evolving, and it may be decades before we have sufficient capabilities to detect ET, if indeed there is anything detectable."

After several years of collecting billions of candidate signals detected by the SETI@home screen saver, in March 2003 the project reobserved about 200 of the most promising sections of sky using 24 hours of dedicated telescope time at the Arecibo observatory. The group analyzed the new data, also using distributed computing, and sifted through the results.

SETI@home's other direction is to improve the technology of distributed computing. They have developed a new platform called BOINC (Berkeley Open Infrastructure For Network Computing), which they will use for future SETI@home projects. According to Anderson, "BOINC has several huge advances beyond our current software." It allows the organization to release new versions of applications or even completely new applications without requiring users to download and install new software. It will also let SETI@home use the storage space (in addition to the computing power) of participating computers. "Of course, participants have total control over how much space is used," he said.

The organization has beta-tested SETI@home on BOINC for several months and will release it to the public in the near future. Other distributed computing projects will also use BOINC: Users can choose which projects they participate in, controlling what percentage of computing power and storage are allocated to each project. A person might, for example, choose to devote 50% of her CPU time to studying global warming, 20% to studying protein folding, and 30% to looking for extraterrestrial life.

"Long-term, we hope that BOINC will greatly increase participation in distributed scientific computing," with perhaps tens of millions of participants, "and will spark the development of lots of new projects in areas like physics, biology, seismology, and so on," Anderson said.

SETI@home is also working on behind-the-scenes efforts to improve its eye on the sky. They developed a new data recorder that can handle multibeam radio telescope receivers, which are telescopes that can listen to several points at once. It will be deployed first at Arecibo and later at Australia's Parkes Observatory.

The group is also in a joint project with NVIDIA (www.nvidia.com) to develop a version of SETI@home that will use NVIDIA's latest graphics coprocessor chip to do number crunching. "This is extremely exciting because these graphics chips have tremendous floating-point computation power. If we

Other Distributed Computing Projects

If putting your computer's unused processor power to work seems like a good idea, there are many other distributed computing projects it can chew on. Some work as screen savers, while others work quietly in the background whenever your computer is on. Don't install them all at once: To be most effective, let your computer work on one project at a time.

More distributed computing projects are listed at www.aspenleaf.com/distributed/distrib-projects.html. If donating CPU time for the good for humanity and solving complex mathematical puzzles don't interest you, some projects listed there will pay you for your computer time.

Folding@home:

www.stanford.edu/group/pandegroup/folding

Goal: To understand protein folding, protein aggregation, and related diseases. This could lead to better understanding of Alzheimer's, cystic fibrosis, and mad cow disease.

ClimatePrediction.Net:

www.climateprediction.net

Goal: To allow an advanced climate prediction model to run on personal computers. This could improve scientific forecasts of 21st century climate.

FightAIDS@home:

fightaidsathome.scripps.edu

Goal: To discover new drugs to fight the AIDS virus by screening ex-perimental drug compounds against evolv- ing strands of the AIDS virus.

Drug Design Optimization Lab:

www.d2ol.com

Goal: To evaluate drug candidates against anthrax, smallpox, Ebola, SARS, and other infectious diseases.

Distributed.net:

www.distributed.net

Goal: To crack the RC5 encryption algorithm and find OGRs (optimal golumb rulers). The RC5 project includes a cash prize. OGRs are useful in X-ray crystallography, radio astronomy, and other fields.

Grid.org:

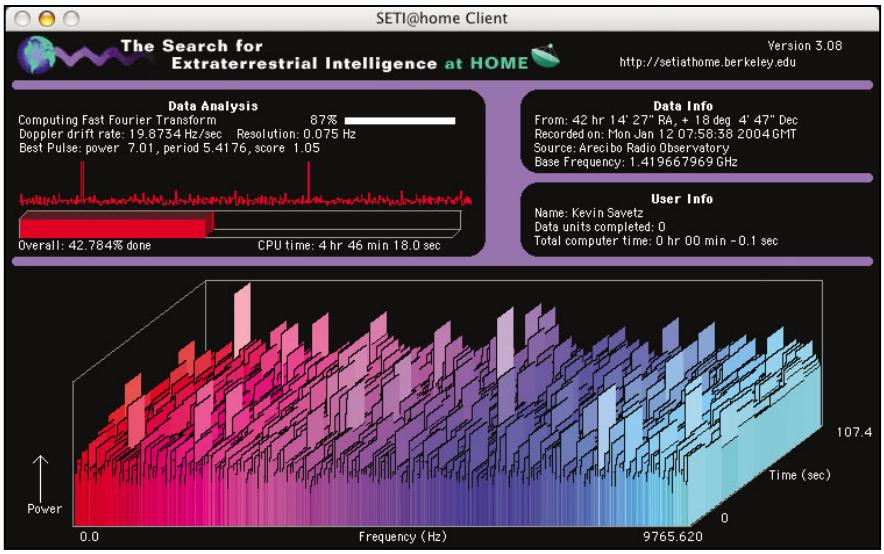
www.grid.org

Goal: To establish a secure grid-computing solution for projects including cancer research and smallpox drug development.

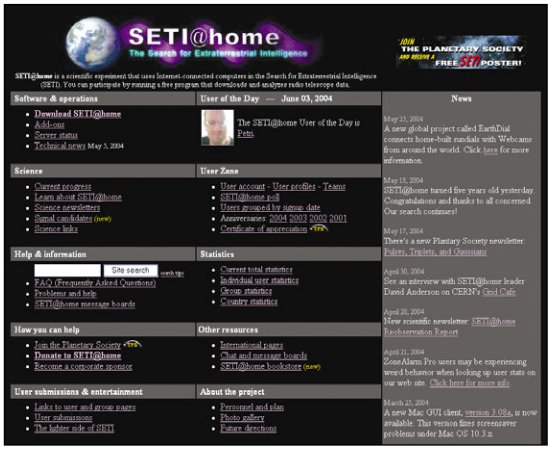
Mersenne Prime Search:

www.mersenne.org/prime.htm

Goal: To discover Mersenne prime numbers, "one of the most coveted finds in all of Mathematics." (On May 14, participant Josh Findley found the 41st Mersenne prime number, which is also the largest known prime number.) ▮


SETI@home Client
The Search for Extraterrestrial Intelligence at HOME
Version 3.08
http://setiathome.berkeley.edu
Data Analysis
Computing Fast Fourier Transform 87%
Doppler drift rate: 19.8734 Hz/sec Resolution: 0.075 Hz
Best Pulse: power 7.01, period 5.4176, score 1.05
Overall: 42.784% done
CPU time: 4 hr 46 min 18.0 sec
Data Info
From: 42 hr 14' 27" RA, + 18 deg 4' 47" Dec
Recorded on: Mon Jan 12 07:58:38 2004 GMT
Source: Arecibo Radio Observatory
Base Frequency: 1.419667969 GHz
User Info
Name: Kevin Savetz
Data units completed: 0
Total computer time: 0 hr 00 min - 0.1 sec
107.4
Time (sec)
0
Power
0.0
Frequency (Hz)
9765.620

The SETI@home screen saver pores over a small part of the data collected by a powerful radio telescope, making it both useful and nice to look at.



The SETI@home Web site gets more than 2 million hits per day. The project has 500,000 active members.

can deal with issues involving their restricted memory architecture, they could provide a huge resource for scientific computing," Anderson said.

How To Get Involved

Becoming part of Earth's extraterrestrial search team is easy. All you need to do is download and run the SETI@home screen saver. On the SETI@home Web site, click the Download SETI@home link and choose the version you need. The software is available for Windows 95/98/2000/NT/Me/XP, MacOS 9/X, Linux, and a bevy of other operating systems. Once it has downloaded, simply run the installer.

The first time it starts, the program will ask a few questions. You can configure it to ask for permission before connecting to the Internet to send and receive work. If you have a dial-up modem connection, this is a good idea. If you have a DSL or cable connection, let it connect automatically whenever it needs to. You can also set the amount of time the computer must be inactive before the screen saver starts.

The program will ask for your name, email address, and ZIP code, providing the option to show or omit your name and email address on the SETI@home Web site. However, providing your name and email address is important. If your computer is the one that finds definitive proof of alien intelligence, you will probably want an email message to hear about it. Also, when you type your email address in the User Account area of the SETI@home Web site, it will provide interesting statistics about how much work your computer has completed.

Because the program is a regular Windows screen saver, you can adjust its settings or turn it off the same way as you can with any screen saver. From the Windows Control Panel, double-click Display and then click the Screen Saver tab. To make your computer get the most from its processing time, you can disable the screen saver graphics: It doesn't look as pretty, but it will process the data faster.

The program isn't limited to running as a screen saver. You can set it to run continually in the background while you work. Do this only if your computer has plenty of processing power and extra memory; otherwise the program can get in the way of your work.

A variety of add-on software is also available for download from the SETI@home Web site. (Click Add-ons under Software & Operations.) These include utilities that show additional data about the signals your computer is analyzing; adds-ons that show the part of the sky it is analyzing; and cache servers that allow you to serve work units to PCs that aren't always connected to the Internet.

If you have more than one computer, you may want to install the screen saver on all of them. Also, a computer that's working hard uses more power than one that's idle, so you probably won't want to let SETI@home run on your laptop when it's running on battery power: The batteries will drain more quickly.

Another way to help the project is to contribute financially. SETI@home is a nonprofit organization, so donations are tax-deductible. You may also want to join The Planetary Society (www.planetary.org), a nonprofit space advocacy group which sponsors SETI@home and seven other SETI projects.

Share The Wealth

Most PC users have so much idle processor power that it's almost silly *not* to put it to good use. Becoming part of such an interesting and thought-provoking project as SETI@home is a good way to do that. If extraterrestrial life isn't your cup of tea, refer to our sidebar to find other worthy projects in which you can participate. PCT

by Kevin Savetz